POWER CONTROL IN A CDMA NETWORK

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BACKGROUND OF THE INVENTION

The present invention relates to CDMA-based radio networks and, more particularly, to packet-switched data services.

IS-95 based CDMA currently has very limited packet-switched data capabilities as disclosed in TIA/EIA/IS-95 Interim Standard, Mobile Station-Base Station compatibility Standard for Dual Mode Wideband Spread Spectrum Cellular Systems, July, 1993 (herein incorporated by reference). The primary limitation is imposed by the reverse link. On the forward link, the paging channel can be used to accommodate outbound traffic, although the maximum data rate imposed is currently restricted to 9600 bps. On the reverse link, two mechanisms exist which can be used to facilitate in-bound traffic. Short messages (i.e. 110 bytes or less) can be accommodated by using the access channel. The peak data rate supported on the access channel is 4800 bps. The random access protocol employed is highly inefficient, yielding data throughputs significantly less than 4800 bps. For longer messages, negotiation of a dedicated traffic channel is required. While the traffic channel is capable of supporting 9600 bps sustained, the set-up times can be prohibitively long for short messages (e.g. 800 msec).

The existing IS-95 channel structure associates a group of reverse access channels with a single forward paging channel. The paging channel is used to carry system configuration information as well as user data. Up to 7 paging channels can be supported currently, each delineated with a sector by a separate Walsh code. Different sectors within the network are delineated by covering all channels in the sector with a complex valued pilot code. The modulation employed on the paging channel is essentially BPSK, using data rates of either 4800 bps or 9600 bps. Currently, there are 64 Walsh codes for channelization on the forward link; however, each Walsh code may be reused to facilitate greater capacity and/or data rates. The paging channel is currently segmented into fixed 80 msec slots.

Associated with each paging channel are 32 reverse link access channels. Access channels are chosen at random by users and are delineated by non-orthogonal codes. The codes within a sector are a function of the sector pilot code, paging channel code and the access channel chosen. The random access protocol employed is based on slotted ALOHA, with the slot size being a system configurable parameter. The parameters governing the protocol permit additional randomization of packets through time offsets to further reduce the possibility of collisions. All packets employ a minimum of 20 msec of un-modulation preamble to allow for acquisition by the base station. The access channel data rate is fixed at 4800 bps, with 64-ary orthogonal modulation being employed.

Mobiles use the access channel to request access to the network respond to page channel messages and send short messages to the base station. The procedures governing it's use are identical, regardless of the transaction classification. Several key factors that limit the efficiency of the access channel for packet data are outlined briefly below:

1. Initial Transmit Power

The initial transmit power employed by a mobile is determined using a simple rule which requires the sum of the received power and transmitted power to the constant. This open loop estimate can be error by as much as 8 dB due to inaccuracies introduced by both the estimation process and mobile implementation. The errors serve to reduce system capacity as well as reduce data throughput.

2. Fixed Transmit Power

The emitted power remains constant for the duration of a packet. However, the channel conditions and interference levels change over the duration of a packet. Since the transmit power remains constant, there are times when the received power is more than adequate and other times when it is less than adequate. This reduces system efficiency.

3. Access Channel Acquisition

The cell site receivers are designed to continuously search for access channel messages. The processing requirements imposed by the access channel structure can be large, particularly when the number of searcher elements becomes limited (i.e. serving cells). When the hypothesis space a single searcher must examine becomes large, the duration of the packet preamble may be extended to avoid missed acquisitions due to limited processing power. This increases the overhead-to-data ratio per packet.

4. Fixed Access Channel Data Rate

The access channel data rate operates at a fixed rate of 4800 bps. In addition, the access channel packet sizes are of fixed duration. Under certain circumstances the network is capable of supporting higher data rate transactions. Support of higher data rates increases overall throughput of the system. There are other circumstances where mobiles may be peak power limited and cannot support reliable communications at 4800 bps. In these cases it is desirable to provide a more reliable lower data rate service alternative.

5. Limited Feedback Channel Information

While using the access channel, mobiles are required to monitor the corresponding paging channel for system status messages as well as messages addressed to specific mobiles. There are not explicit feedback mechanisms employed at the physical layer such as power control, channel busy/idle status and system load. The lack of timely feedback information severely limits the throughput and capacity of a packet data service.

6. Soft Handoff

There is currently no mechanism to support soft handoff while using the paging or access channels. Traffic channel operation is currently the only channel type for which soft handoff is supported. This may limit the coverage, capacity and throughput capabilities of a packet service.

SUMMARY OF THE INVENTION

In accordance with the invention, a method if a packet-switched CDMA network for communicating between a base site and a mobile site comprises the steps of: transmitting signaling traffic from the mobile site to the base site; acquiring the transmitted signalling traffic at the base site and responsively communicating power control data to the mobile site; and receiving and interpreting said power control data at the mobile site and adjusting the transmission of said signaling traffic in accordance with said interpreted power control data.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a flowchart demonstrating one aspect of the present invention.